

1.		
(a)	Base clearly circled;	1
(b)	(The pentose in) RNA is ribose <u>and</u> in DNA is deoxyribose; the base thymine is only found in DNA <u>and</u> the base uracil is found in RNA; NOT: ref. helix/strands/uracil and thymine unqualified	2
(c)	Adenine with thymine <u>and</u> cytosine with guanine; Appropriate use of {data/ratios} for {human/sea urchin/wheat}; Need data on both A T and C G NOT 'they are the same' or reference to ratio the same in all organisms	2
Question 1 total		[5]

2.		
(a)	deoxyribose/ pentose/ 5 C sugar	1
(b) (i)	A-T-A-G-C	1
(ii)	Guanine pairs with cytosine/ G pairs with C = 60%/ G+ C = 60%; A+T= 40% A= 20% (any two) Correct answer = 2 marks	2

(Total 4 marks)

- 3.
- (a) (i) Nucleotide; 1
- (ii) Phosphate / phosphoric acid / PO_4 / PO_3^- ; 1
NOT phosphorus / P
- (iii) Deoxyribose in DNA **and** ribose in RNA (both); 1
- (iv) Adenine, Thymine, Cytosine, Guanine (1 if 1 error). 2
- (b) **Any 4** 4
- Pairing described A-T and C-G (both needed);
- Backbone / Chains / polynucleotide formed by alternating sugar phosphate groups;
- two chains connected / joined by base pairs;
- hydrogen bonding;
- two chains (twisted) to form a helix / double helix;
- NOT alpha helix.
- Accept labelled diagram.
- (c) {forming template / code / instructions} for {protein synthesis / mRNA 1
/ amino acid sequence / primary structure of protein / transcription}
(accept Replication in dividing cells) /
NOT genetic material alone.

Question total 10

4.

(a)

	DNA	m-RNA
Name of sugar	deoxyribose	ribose;
Number of carbon atoms in sugar	five	five;
Number of polynucleotide chains in molecule	two	one;
Location in cell	nucleus	nucleus + cytoplasm; (allow: RER/ ribosomes)

[4]

(b)

- (i) base pairing;
Complementary/ adenine with thymine;
not identical because of experimental error;

[3]

- (ii) passed on from parents/during fertilization/inherited/zygote formation;
from same cell/mitosis;
DNA replication;
genetically identical / same base sequence/ all body cells have same DNA

[3]

- (iii) half as much; DNA (not: ref chromosomes)
variation/ genetically different
produced by meiosis;

[3]

(Total 13 Marks)

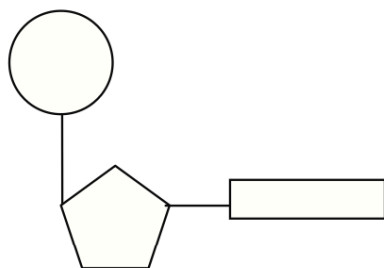
5.

	DNA	RNA
Contains a pentose sugar	✓	✓
Found in the nucleus	✓	✓
Thymine is never present	×	✓
Consists of a double helix	✓	×
Molecules short lived	×	✓
Associated with ribosomes	×	✓

[Total 6 marks]

6.

(a) (i)



Pentose shown as pentagon and labelled, sugar/ribose/deoxyribose [1]
 Phosphate on C5 and labelled, phosphate/phosphoric acid [1]
 Base on C1 and labelled, (nitrogenous) base/named base [1]

(ii) The pentose is ribose in RNA deoxyribose in DNA; [1]
 (allow: clear description of extra oxygen e.g. sugar in DNA contains one less oxygen atom than sugar in RNA)
 the base thymine is only found in DNA / uracil in RNA. [1]
 (not: ref. helix/strands/uracil and thymine) Comparison needed

(b) (i) (Alternating) sugar / pentose or deoxyribose and phosphate. [1]

(ii) Adenine with thymine. [1]
 Cytosine with guanine. [2]
 (not: abbreviations) Correct spelling thymine/cytosine.
 (iii) Hydrogen. (not: H) [1]

[Total 9 marks]

7.

(a) DNA contains deoxyribose (sugar); RNA contains ribose. (1)

DNA contains thymine base: RNA contains uracil (1)

DNA is a double helix / stranded; RNA is single stranded.

(correct spelling thymine; not : CTAG, ref to size / length / different forms of RNA)

8.

- (a) (i) Transfer/t RNA;
Ribosomal/r RNA; [2]

- (ii) Comparative statements required.
Similarity, double stranded [1]
(allow: ref. to both are polynucleotides; not: nucleotide constituents)

Differences;
Ribose;
Uracil not thymine;
Smaller.
Found in cytoplasm
Not a double helix [max 3]

- (b) (i) 50% [1]

- (ii) 1 mark for each base + correct %

Nucleotide	%
<i>Adenine</i>	<i>10</i>
Thymine	10
Cytosine	40
Guanine	40

Full names and correct spelling required.

9.

DNA Q mark scheme

- | | | | |
|-----|-------|--|---|
| (a) | (i) | A DNA
B RNA | 1 |
| | (ii) | Ribose (not: pentose) | 1 |
| | (iii) | Nucleus/nucleolus/mitochondria/chloroplasts | 1 |
| | (iv) | Hydrogen | 1 |
| | (v) | RNA/B is a short molecule, DNA/A is a long molecule;
Pentose in DNA contains one less oxygen.

RNA/B is much shorter than DNA/A;
A is helix, B is straight molecule/not helix.

Uracil replaces thymine in RNA/B.
(not: DNA has deoxyribose and RNA has ribose) | 1 |
| (b) | (i) | A bond/base pairs with T and C with G. | 1 |
| | (ii) | Any suitable figure from table indicating
A approx = T/C approx = G
(data and species) | 1 |
| | (iii) | Purines. | 1 |

Total 8 marks

10.

- | | | | |
|-----|--|---|---|
| (a) | Thymine | 1 | |
| | Cytosine | 1 | |
| | Adenine | 1 | |
| | Guanine | 1 | |
| (b) | (i) | X = Nucleotide | 1 |
| | (ii) | phosphoric acid/phosphate | 1 |
| | | organic base/nitrogenous base/cytosine | 1 |
| | | pentose (sugar)/Deoxyribose/5C sugar
(not: Pi/base/purine or pyrimidine) | 1 |
| (c) | Z = Hydrogen bond | 1 | |
| (d) | deoxyribose and phosphate/deoxyribose and (nitrogenous) base
or named/pair of entities e.g. amino acids/sugars
(Any 1) | 1 | |

- (e) uracil/ribose/single strand/shorter/lower molecular weight/transcription occurring
(Any 2) 2
[12]

11.

- (a) **A** Pentose sugar / deoxyribose (allow: 5 carbon sugar) (1)
B Phosphate (1)
 (b) Hydrogen (Bonding) (not: H) (1)
 (c) (i) Purine (1)
 (ii) **C** Adenine (1)
D Thymine [allow a consequential error here] (1)

Reject abbreviations A/T / consequential error if C is uracil.

- (d) Ring should cover any 1 base with 1 sugar and 1 phosphate (through dotted lines i.e. bond). (1)
 (e) If 28% G then C must be 28% (1)
 $(28+28 = 56) / 100 \Rightarrow 56 = 44 / (A+T = 44)$ (1)
 $T = 22(\%)$ (1)

1 mark for each correct line.

Total 10 marks

12.

a	X	phosphate;	
	Y	deoxyribose/pentose (sugar);	2
b	21	29;	
	17	17	2
	Cattle	A=T/C=G;	
	Octopus	G+C=100-(A+T)	2
c	<u>DNA</u>	<u>RNA</u>	
	long molecule/ larger	short molecule/ smaller	
	two strands/ H bonds	one strand/ no H bonds	
	deoxyribose sugar	ribose sugar;	
	has thymine	has uracil	
			MAX 2

13.

- | | | | |
|-----|------|---|---|
| (a) | (i) | DNA molecule unwinds;
Unzips/ breaks hydrogen bonds/ strands separate;
(free) { <u>nucleotides</u> } {join/align} with {complementary bases/ A to T/ C to G}; | 3 |
| | (ii) | {To join the nucleotides together/ catalyses the addition of nucleotides} to form a {new strand/ backbone/ phosphodiester bonds}; | 1 |
| (b) | | Each new DNA <u>molecule</u> has one {original/ template} strand;
And one new strand which has been { <u>made/ synthesised/ replicated</u> }; | 2 |

Question 2 Total **[6]**

14.

- | | | | |
|-----|-------|---|---|
| (a) | 40; | 1 | |
| (b) | (i) | Correct diagram;
two chromosome pairs vertically orientated
one of each pair on each side of the equator
one pair of chromosomes bigger than the other | 1 |
| | (ii) | Correct labelling of
chromatid, <u>centromere</u> , <u>centriole</u> , spindle fibres
2 marks for 4 correct labels
1 mark for 2 or 3 correct labels | 2 |
| | (iii) | Correct diagrams;
Two chromosomes in each cell (one large and one small)
Centromeres on dotted line | 1 |
| | (iv) | {Random/ independent} assortment of {chromosomes/ chromatids}/ description of {random/ independent assortment};
crossing over/ chiasmata;
produces haploid cells; | 3 |

Question 3 Total **[8]**

15.

- | | | |
|-----|--|---|
| (a) | RNA polymerase; | 1 |
| (b) | (i) CGT TAC CAA; | 1 |
| | (ii) CGU UAC CAA; | 1 |
| (c) | (i) Alanine; | 1 |
| | (ii) <ul style="list-style-type: none"> • Mutation 1 – no change to sequence of amino acids; • Codon for alanine / degenerate codon / same amino acid coded for; Neutral mutation; | 2 |
| | <ul style="list-style-type: none"> • Mutation 2 – valine replaced by alanine / codon for alanine; • (Tertiary) {structure / shape of protein} may change / position of bonds may change / sequence of amino acids changing / structure of protein changing / protein non functional; | 2 |
| (d) | <ul style="list-style-type: none"> • Translation prevented; • Tetracycline {binds to / blocks / inhibits} {mRNA triplet / codon / CGC / second attachment site}; • {Anticodon / tRNA triplet} cannot pair with {mRNA triplet / codon} / cannot form codon-anticodon complex; • Amino acid not added to polypeptide chain / peptide bonds not formed; | 3 |

(Any 3 points)

Question total 11

16.

- (a) Each strand of DNA used as a template to make a new DNA strand;
New DNA (mols) made of an old/original strand linked to a new strand; (not: if ref. to new DNA strand) **2**
- (b) (i) nitrogenous bases/organic bases/purines and pyrimidine bases/ all four named
(not: bases/letters only/nucleotide) **1**
- (ii) spin (at same) speed;
(Same) time;
(Same) density/concentration of gel;
(Same) temperature
(not: pH/ref. volume or mass) **Max 2**
- (c) (i) Tube A all heavy/ N^{15} ;
Tube B DNA mixture of heavy and light (so intermediate position)/ $N^{15} + N^{14}$;
DNA in B must be made from one strand of heavy and one light;
If conservative would get two bands in light and heavy position. **Max 3**
- (ii) C intermediate and light equal amounts;
(touching dotted lines)
D intermediate and light more light than intermediate
e.g. shown as thicker or wider line;

5.

- (a) (i) X transcription;
Y translation; **2**
- (ii) 8 marks on diagram **8**
S- to line between anticodon/codon; T – to solid line not dotted line; R not if just labelled to black circle
- (b) CCT ACA GCA CGT
All correct 2 marks
2/3 correct 1 mark

17.

- | | | |
|-----|--|---|
| (a) | Shaded on diagram | 1 |
| (b) | B + D (both needed) | 1 |
| (c) | Haploid kangaroo C (not: if more than 1 letter) | 1 |
| | Diploid mosquito A | 1 |
| (d) | (i) Diploid means <u>a pair</u> (of each) chromosome
(not: 2 chromosomes present) because meiosis could not take place/
because haploid can't be less than 1 or equiv. | 1 |
| | (ii) Mitosis. (correct spelling required) | 1 |
| (e) | (i) Q S M N P R | 1 |
| | (ii) Q | 1 |
| | P | 1 |
| | Q | 1 |
| | S | 1 |
| | R | 1 |
| | (If words used minus 1 mark) | |

12 MARKS

18.

- | | | | |
|-----|-------|---|---|
| (a) | (i) | A A U A G A A A G C C C U A C | 1 |
| | (ii) | tyr, arg, ala, ser, leu. (abbreviation or full name) | 1 |
| | (iii) | Start codon / AUG (allow: ref. 5-3 direction)
(not: punctuated/stop codon) | 1 |
| | (iv) | Mutation (not: chromosome mutation). | 1 |
| | (v) | Amino acid sequence different/one less/ thr, glu, his, arg/alters primary structure/different polypeptide chain.
(not: sequence is wrong/different protein/ref. reading frame) | 1 |
| (b) | (i) | 4 | 1 |
| | (ii) | Switches on gene which codes for gamma chain;
(not: fetal haemoglobin/HbF)

mRNA made;

Transcription or description;

mRNA translated or description;

Ribosomes;

Ref <u>role</u> tRNA;

Ref formation of <u>peptide</u> bonds.

Max 4 | 4 |
| | (iii) | Reduced oxygen supplied to tissues/haemoglobin doesn't carry as much oxygen (not: no oxygen/ref. affinity) | 1 |
| | (iv) | Foetus would not be provided with sufficient oxygen/
Oxygen would not be supplied to tissues until pp of oxygen low/affinity for oxygen too high. (not: higher) | 1 |

12 MARKS

Essays

1.

(b)	<p>A. Ref to DNA and RNA;</p> <p>B. Diagram/description of a nucleotide with correct labels/terms (phosphate & pentose sugar & nitrogenous/eq base);</p> <p>C. DNA named sugar Deoxyribose; must link to DNA</p> <p>D. Ref to purines and pyrimidines;</p> <p>E. Correct identification of purines and pyrimidines (Full names only);</p> <p>F. Ref to Uracil replacing thymine in RNA;</p> <p>G. Correct base pairing A-T, C-G (<i>Allow letters;allow from diagram</i>)</p> <p>H. Description/labelled diagram of <u>double</u> helix in DNA;</p> <p>I. Held together by H – bonding;</p> <p>J. Functions of DNA (i) replication in dividing cells;</p> <p>K. (ii) code/ template for protein synthesis;</p> <p>L. Description of RNA as a single chain/ strand (of nucleotides); NOT single helix</p> <p>M. Ref correct sugar Ribose in RNA; correctly linked</p> <p>N. mRNA carries genetic code from the nucleus to the ribosome;</p> <p>O. correct reference to tRNA/ribosomal RNA;</p>	[10]
Question 8 Total		

2.

- (b)
- A polynucleotide/chain of nucleotides;
 - B nucleotide consists of phosphate, sugar plus base;
 - C sugar is deoxyribose;
 - D base contains nitrogen; (allow: ref. nitrogenous)
 - E four bases are adenine, guanine, cytosine and thymine; (not: letters/ref. uracil)
 - F sugar phosphate backbone;
 - G two polynucleotide chains linked;
 - H antiparallel (stated, in context);
 - I ref. polynucleotide chains/base pairs held together by hydrogen bonds;
 - J complementary base pairing;
 - K A-T, G-C;
 - L pairing of purines and pyrimidines;
 - M double helix;
 - N purines double ring and pyrimidines are single ring;
 - O ref. sequence of bases is genetic code;
- 10**

3.

- (b)
- A Both contain the elements CHON;
 - B Both can link to form larger molecules/polymers/ref. monomers;
 - C Nucleotides consist of nitrogenous base;
 - D plus pentose and phosphate; (not: 5C sugar)
 - E bases are pyrimidines and purines;
 - F Amino acids possess an amine/NH₂ group/carboxylic group;
 - G Variable R group;
 - H More/20 types of amino acid;
 - I Amino acids link together by peptide bond formation/sugar phosphate backbone;
 - J Five different bases in nucleotides/5 named; (not: letters only)
 - K Bases can undergo complementary base pairing;
 - L Adenine with thymine or uracil and guanine with cytosine;
 - M By hydrogen bonds;
 - N Nucleotides carry genetic information;
 - O Sulphur containing vs. phosphate containing.

10 MARKS

- 4.
- (a) (i)
- | | | |
|---|--|-----|
| A | DNA is a polymer of many nucleotides / nucleotide chains / polynucleotide; | [1] |
| B | The nucleotide contain the (5-carbon sugar / pentose sugar) deoxyribose; | [1] |
| C | Attached to which is a base, either thymine, cytosine, adenine or guanine; | [1] |
| D | The base is either a purine or a pyrimidine; | [1] |
| E | T and C are pyrimidines, A and G are purines; | [1] |
| F | The nucleotides are linked in a chain by alternate phosphate / sugar links/sugar phosphate backbone; | [1] |
| G | One nucleotide can join to another by a condensation reaction; | [1] |
| H | DNA consists of two of these chains twisted helically / double helix | [1] |
| I | (Diagram showing) strands linked through correct A-T, G-C base pairings; | [1] |
| J | Complimentary bases linked by hydrogen bonds. | [1] |
- (Any 7 from A-J)
- (ii)
- | | | |
|---|--|-----|
| K | DNA contains deoxyribose sugar and RNA contains ribose; | [1] |
| L | DNA contains thymine (base) and RNA contains uracil; | [1] |
| M | DNA the bases are paired, in RNA they are unpaired; | [1] |
| N | DNA is a double helix/stranded and RNA is single stranded; | [1] |
| O | DNA is longer than RNA; | [1] |
- (Any 3 comparative points from K-O)
- [Total 10 marks]**

5.

(a)

- A. {nucleotide/ base} sequence of DNA contains code for {primary structure of polypeptide/ amino acid sequence};
- B. Triplet base hypothesis/ 3 bases = 1 amino acid/ triplet code;
- C. transcription;
- D. RNA polymerase links to DNA;
- E. DNA unwinds / unzips;
- F. (One of) DNA strands acts as {coding/ template/ sense} strand;
- G. {mRNA } synthesised;
- H. complementary base pairing + detail of A-U C-G;
- I. mRNA leaves nucleus through a nuclear pore;
- J. translation;
- K. mRNA {held by/ attaches to} a ribosome/ ribosome moves along mRNA molecule;
- L. Two tRNA binding sites on each ribosome;
- M. each tRNA has its own specific amino acid;
- N. tRNA molecules bind to codon on mRNA via an anticodon;
- O. peptide bond formed between amino acids on adjacent tRNA;
- P. Reference to ATP use {in Amino acid activation/ formation of peptide bonds};